

Perceptions of a short animated film on adverse childhood experiences: a mixed methods evaluation

Ford, Kat; Bellis, Mark A.; Isherwood, Kate; Hughes, Karen

BMJ Open

DOI:
[10.1136/bmjopen-2021-050398](https://doi.org/10.1136/bmjopen-2021-050398)

Published: 17/08/2021

Publisher's PDF, also known as Version of record

[Cyswllt i'r cyhoeddiad / Link to publication](#)

Dyfyniad o'r fersiwn a gyhoeddwyd / Citation for published version (APA):
Ford, K., Bellis, M. A., Isherwood, K., & Hughes, K. (2021). Perceptions of a short animated film on adverse childhood experiences: a mixed methods evaluation. *BMJ Open*, 11(8), [e050398]. <https://doi.org/10.1136/bmjopen-2021-050398>

Hawliau Cyffredinol / General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

BMJ Open Perceptions of a short animated film on adverse childhood experiences: a mixed methods evaluation

Kat Ford ¹, Mark A Bellis ^{1,2}, Kate R Isherwood ³, Karen E Hughes ^{1,2}

To cite: Ford K, Bellis MA, Isherwood KR, *et al.* Perceptions of a short animated film on adverse childhood experiences: a mixed methods evaluation. *BMJ Open* 2021;**11**:e050398. doi:10.1136/bmjopen-2021-050398

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online. (<http://dx.doi.org/10.1136/bmjopen-2021-050398>).

Received 20 February 2021
Accepted 26 July 2021



© Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹Public Health Collaborating Unit, School of Health Sciences, College of Human Sciences, Bangor University, Wrexham, UK

²World Health Organization Collaborating Centre on Investment for Health and Well-being, Policy and International Health, Public Health Wales NHS Trust, Wrexham, UK

³Research and Evaluation Division, Public Health Wales NHS Trust, Cardiff, UK

Correspondence to
Dr Kat Ford;
k.ford@bangor.ac.uk

ABSTRACT

Objectives An evaluation of a short animated film on adverse childhood experiences (ACEs) to explore attitudes and sentiment towards the film including, for a subsample of professionals, associations between attitudes and personal experience of ACEs.

Design Mixed-method exploratory design.

Setting Professionals and the general public.

Participants A short online survey with 239 professionals. Interaction and user sentiment towards the film on social media (Twitter, YouTube).

Primary and secondary outcome measures Survey: participants' attitudes towards the film including feelings invoked, learning gained and ACE count prevalence. Twitter user and YouTube viewer sentiment (positive, negative or neutral) and interaction (likes, retweets or comments) with the film.

Results Attitudes to the film were positive: 94.1% and 93.7%, respectively, agreed that it provided a helpful explanation of ACEs and trusted that the film was credible. Of those who reported ACE exposure, 88.9% agreed that those with ACEs would benefit from watching the film. Despite 50.6% reporting that the film had made them feel sad or upset, the majority (66.4%) reported they found the film hopeful or encouraging. Across 358 publicly available tweets from 313 users, 39.1% of tweets expressed positive sentiment, with only 1.4% negative (59.5% neutral). However, there was no association between tweet sentiment and interaction. Thirteen YouTube versions of the film received 171 812 views, 97.3% (n=889/914) ratings were positive (ie, 'thumbs up').

Conclusions Despite being emotionally arousing, many professionals reflected positive impacts of the film including a perceived increased ability to discuss ACEs. Public sentiment demonstrated a positive reaction to and acceptability of the film. Understanding the professional and public response to materials developed to increase ACE awareness, such as the film explored here, is important given the growing number of international movements which seek to increase ACE awareness, prevent ACEs and mitigate their lifelong negative effects.

INTRODUCTION

Adverse childhood experiences (ACEs) refer to some of the most severe sources of stress children can be exposed to, including child abuse or neglect, parental substance misuse or parental imprisonment.¹ Internationally,

Strengths and limitations of this study

- A mixed methods approach was used to evaluate the film, including a short survey with professionals, and retrospective analysis of public reaction and interaction with the film on social media (Twitter and YouTube).
- An examination of attitudes towards the film according to individuals' adverse childhood experience (ACE) exposure was included to measure sensitivity of this approach of message conveyance to individuals with such experiences.
- ACE exposure was self-reported and measured retrospectively and therefore is vulnerable to issues of recall and willingness to report.
- Survey data were anonymous which prevents follow-up to explore long-term memorability or any impact on practice from viewing the film.
- Analysis of Twitter data provides the ability to explore dynamic responses and demonstrate reach, but is limited to user accounts which are publicly available, who are not likely to be representative of the general population.

studies have evidenced a link between exposure to multiple ACEs before the age of 18 years and negative lifetime outcomes for physical and mental health, education and employment, the adoption of health-harming behaviours and involvement with criminal justice.^{2–5} Annual costs attributable to ACEs across a range of risk factors and causes of ill health have been estimated to be \$1.3 trillion across Europe and North America⁶ and £42.8 billion in England and Wales.⁷ Internationally, local and national policies are prioritising the prevention and response to ACEs.^{8,9} Movements such as ACE-Aware Scotland (UK), the California ACEs Aware Initiative (USA) and Welsh strategy to create 'ACE aware' services (<https://www.aceawarewales.com/>) seek to promote a response to ACEs, including increased ACE awareness. Awareness of ACEs and their associated life-course harms is increasing among professionals, including those employed within public,

youth and third sectors.¹⁰ However, there is a dearth of knowledge on how information on ACEs can be effectively communicated to professionals or more broadly to the public.

Following ACE prevalence studies in Wales (national)¹¹ and England (national and regional),^{12,13} a short animated film on ACEs (<https://youtu.be/XHgLYI9KZ-A>) was developed by Blackburn with Darwen (BwD) Borough Council and Public Health Wales (PHW). The film was designed to act as a professional training tool to communicate information on ACEs, their potential to damage health across the life course and the roles that different agencies can play in preventing ACEs and supporting those affected by them. The film lasts 5 min and 43 s and provides the narrative of a young boy growing up with ACEs—‘one person’s story on how ACEs affected their life’. The film suggests the impact his exposure to ACEs may have on his physical health (eg, development of cancer, heart disease, early mortality), mental health (eg, impulsivity control), involvement in health-harming behaviours (eg, alcohol use, smoking, violence perpetration), educational attainment (eg, school truancy, expulsion) and the potential generational transmission of ACEs (eg, exposure of his future children to subsequent ACEs). The film highlights the need for services (eg, health, police and education) to be ACE aware. It shows how, with the support of services, the boy is able to have an alternative life course and his future children prevented from being exposed to ACEs. The film therefore not only highlights the harm that ACEs cause but also shows how support can provide resilience to help individuals’ follow different life trajectories. After being piloted within professional training, the animation was published online on 28 April 2017 and shown at a variety of relevant professional stakeholder conference and training events. The film was made freely available on the social media platform ‘YouTube’ (with embedded links to the video hosted on BwD Borough Council and PHW webpages). Three language versions were produced (English language and accent, English language with Welsh accent and Welsh language).

Subsequent films on the theme of ACEs have been created in the UK by NHS Scotland and the Early Action Together Police and Partners ACEs Programme. However, to date no studies have examined the response towards the use of such short animated films as a tool to deliver public health messages on ACEs. Even when adopting a broader examination of public health messaging, the evidence base for the use and impact of films is limited, as film interventions are rarely evaluated and their impact is often not systematically assessed. Public health messaging needs to capture attention and convey messages to a wide audience in an accessible format. However, only a few studies examine the use of animated films to convey such messages, often focusing on the provision of education to children, for instance, on dental caries.¹⁴ Some research does indicate that the use of animated cartoons in communicating public health messages leads to higher

message recall.¹⁵ We sought to add to the evidence base on the use of films for public health messaging, by evaluating professional and public reaction to the short ACE animated film. The evaluation included an examination of professional and public reaction to, and interaction with, the online ACE animated film. Although developed as a professional training tool, the film was publicly available on social media (ie, Twitter, YouTube) and gained increasing reach and visibility from being shared on such platforms. The reach of the film also grew as, anecdotally, the film had been used by other organisations for training purposes. At the time of the film’s release, no public awareness campaigns on ACEs existed within the UK. It was therefore important to capture public interaction with, and response to, the film. Social media offers a novel research setting due to its low cost and widespread distribution of messages,^{16,17} while providing a real-time function to determine reaction to public health messaging.¹⁸ Understanding social media interaction can provide an indication of opinion towards the film, generating knowledge on how films can be used to support public health messaging and how information on ACEs can be effectively communicated. The past decade has witnessed increasing uptake in social media use. In 2019, an estimated 3.5 billion people worldwide actively used social media, a 9% increase from the previous year.¹⁹ The social media site, Twitter, currently has 187 million daily active users worldwide.²⁰ The platform, where users can create and share user-based content—a ‘tweet’—of up to 280 characters or less, is a useful tool for the dissemination of information given its predominant focus on publicly available content. Because of its reach and diverse population of users, Twitter is increasingly used by researchers to interact with participants (eg, participant recruitment), disseminate research findings, generate impact and drive policy.¹⁶ Furthermore, due to the volume of publicly available data, researchers have started to use data from the site for surveillance of topics/trends, content or sentiment analysis of tweets and to understand user engagement and network analysis.²¹ Other social media platforms, including YouTube, are increasingly being recognised as a source for public health information, yet the content of such videos can contain misleading information.²² Recent years have shown an increase in research using social media content to assess opinion on, and interaction with, public health research, policy and campaigns.^{23–27}

To add to the evidence base for films to support public health messaging, this study evaluated the short ACE animated film, including perceptions among professionals towards the film, as well as any associations between perceptions and personal experience of ACEs. Understanding how attitudes towards the film vary according to individuals’ ACE exposure is important to ensure sensitivity of this approach of message conveyance to individuals with such experiences. Furthermore, public engagement with the film on social media (Twitter and YouTube platforms) was explored to understand

interaction with the film and further evaluate user sentiment towards it.

METHODS

This study used a mixed methods approach, including a short survey with professionals, and retrospective analysis of publicly available social media interaction with the film using the platforms Twitter and YouTube. Furthermore, contact was made with the producers of the film to identify any wider examples of its use.

Survey

A short anonymous survey was developed to explore views on the film among professionals. The survey was piloted at a public health training event (January 2017) where participants were asked to view the film and complete a paper survey (n=59). Following the film's online publication, conference and training attendees at a range of professional stakeholder events (conferences and training, March 2017–June 2017) were directed to a web link where they could view the film and take part in an online version of the survey (accessed through an embedded link within the film). A target sample size of 200 was set, to include a range of possible views across different professional agencies and sectors.

Questionnaire

Questions used a 5-point Likert Scale (1 strongly disagree to 5 strongly agree) to explore participant opinions on the film including: its comprehension, credibility and helpfulness; how the film made the participants feel (ie, upset or sad, hopeful or encouraged) and learning from viewing the film (ie, ability to talk about ACEs, if they felt people would benefit from watching the film). Participants were also asked to rate the amount of information in the film and the length of the film. Participant demographics (age, gender, profession, country of residence) were recorded. From a list of 10 ACE types (physical, sexual or emotional abuse, physical or emotional neglect, domestic violence, household substance abuse, mental illness, parental separation or divorce, incarcerated household member), participants were asked to report the total number of ACEs they had experienced before the age of 18 years (response options: 0 ACEs, 1 ACE, 2–3 ACEs and ≥4 ACEs). All outcomes were self-reported. The full survey is shown in online supplemental file 1.

All potential participants were provided with an information sheet outlining the survey purpose, what participation involved, its voluntary, confidential and anonymous nature and how the data would be stored. It was made clear that participants did not have to answer all questions. Participants gave active consent to the use of their responses for research purposes. All study materials were available in English and Welsh. Individuals aged 18 years or over were eligible to participate, no other stipulations were set for study inclusion or exclusion. Overall, 241 individuals (182 online, 59 paper) completed the survey.

Two respondents were removed from the sample: one respondent who did not consent for their data to be used for research purposes and one who had answered less than 50% of the survey questions, leaving a final sample for analysis of 239.

Analysis

The anonymous data collected were entered directly into SPSS V.24 for analysis. Participant age was coded into groups (≤34, 35–44, 45–54, 55+ years), responses on the Likert scales were dichotomised into agree (strongly agree/agree) versus disagree/neither (neither agree/disagree, disagree or strongly disagree). Profession was grouped into health or social services, employed in another public service (eg, police, education) and other (including: employed in another sector, student, unemployed and retired). Descriptive statistics explored the demographics of the sample and attitudes towards the film, with bivariate analysis employed to analyse any association between demographics and exposure to ACEs with attitudes to the film.

Twitter

In line with other research,²⁸ a series of searches were run using the Twitter advanced search engine function. Terms included: adverse childhood experiences, ACEs, animation, film and Wales, as well as the web links for the online film. Search parameters were set to capture tweets posted between 28 April 2017 (the launch of the animated film online) and 10 April 2019. Due to release of a subsequent ACE animation by NHS Scotland during the data collection period, tweets which included the terms '@NHS_HS' and 'Scotland' were excluded (ie, used the search filter 'none of these words'). No limitation was set on the language or geography of included tweets. The publicly available tweets returned were manually entered into Excel recording: tweet content, username, time and date of tweet and tweet type (ie, tweet or retweet). Any tweets which were not in English were run through Google Translate. If applicable, information on the number of retweets, 'likes' and any comments made on the tweet by other users was also extracted. Where available, information from the user profile for each tweet including: name, biography, geographical location and number of tweets and followers were collected. Results from searches were then combined.

Due to the time delay between the release of the film and data collection, we were unable to retrospectively seek consent from Twitter users. However, data collection followed ethical guidelines on the use of data collection using Twitter²⁹ and as such no individual tweets are presented here.

Analysis

A total of 1244 tweets were retrieved across the searches. In line with other studies,¹⁸ duplicate tweets were removed from the data (n=352) so that all included tweets were unique; however, if a tweet by one user copied another

users' content (not a direct retweet) this was counted as a new tweet. All tweets were categorised for inclusion and exclusion by two reviewers (KF and KI) and excluded if they were not of relevance to the short film (n=534). There was an excellent level of agreement in coding between reviewers (98.3%), Cohen's κ 0.965. Removal of duplicate tweets left 358 original tweets for analysis.

As per other research using Twitter data,^{27 30 31} each tweet was manually coded as having either a (1) positive, or (2) negative, or (3) neutral sentiment towards the film. Only sentiment which was directed towards the film was coded and where content was both simultaneously negative and positive, this was coded as neutral. Content that indicated the user felt sad or upset after viewing the film was coded as negative sentiment. Coding produced 92.7% agreement between two researchers, Cohen's κ of 0.856. Using the user profile description, users were categorised as an individual or organisation. Included tweets were entered into Excel with analysis run in SPSS V.24.

YouTube

On 20 September 2019, the video platform site YouTube was searched to explore the publication of and any subsequent interaction with the animated film, using the search term 'adverse childhood experiences'. For each version of the film retrieved, the following data items were recorded and entered into Excel: version (eg, English, Welsh), publisher and number of subscribers, date of publication and viewer interaction (number of: views, 'thumbs up' (positive user rating), 'thumbs down' (negative user rating) and any comments left on the video, where applicable). Comments were subsequently categorised by two reviewers (KF and KI) by sentiment (positive, neutral, negative; using same categorisation as above; 100% agreement between reviewers). The search retrieved 572 videos of which 13 were a publication of the film.

Other dissemination/use of the film

The developers of the film (N=2) were contacted to identify any further use and distribution.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

Survey

Participant demographics are outlined in table 1. The majority of participants (77.3%) were female, aged 35–54 years (68.2%) and worked in health or social services (51.3%). A similar proportion of participants were Welsh (45.5%) or English (46.0%), with less than 1 in 10 (8.5%) reporting that they were either from Ireland or Northern Ireland. Overall, 6 in 10 (60.1%) participants reported that they had watched the film while in training or at a conference. Fourteen individuals did not disclose their

Table 1 Survey participant demographics and ACE count

		%	n
Gender	Male	22.7	54
	Female	77.3	184
	Missing		1
Age group (years)	≤34	14.2	33
	35–44	33.9	79
	45–54	34.3	80
	55+	17.6	41
	Missing		6
Profession	Health or social services	51.3	121
	Public services	33.1	78
	Other sector	12.7	30
	Student or unemployed	3.0	7
	Missing		3
Location	Wales	45.5	107
	England	46.0	108
	Other*	8.5	20
	Missing		4
ACE count	0 ACEs	46.7	105
	1 ACE	25.3	57
	2–3 ACEs	19.1	43
	≥4 ACEs	8.9	20
	Missing		14
Referral to film	Watched in training/conference	60.1	143
	Referred by a colleague/friend/family member	37.8	90
	Online	2.1	5
	Missing		1

*Includes Ireland and Northern Ireland.
ACE, adverse childhood experience.

ACE count. Of those who did, just over half (53.3%) reported that they had experienced at least one ACE, with 8.9% reporting exposure to ≥4 ACEs.

The majority of respondents reported positive attitudes to the film, with over 9 in 10 reporting that they agreed/strongly agreed (reported here as agreed) that the film was easy to understand (97.9%; table 2), contained useful information (97.5%), provided a helpful explanation of ACEs (94.1%) and that they trusted that the film was credible (93.7%). Just under 1 in 20 reported that they felt the film was confusing (4.6%). The majority of participants also reported positive attitudes to the length of the film (92.4%, 'just right') and that the amount of information in the film was 'just right' (89.7%). Despite half the sample (50.6%) reporting that the film had made them feel sad or upset, only just over 1 in 10 (15.1%) reported that the film was difficult or distressing to watch. The majority reported that they had gained something positive from watching the film and that they were glad that they had watched it (81.2% and 94.9%, respectively). While two-thirds (66.4%) agreed that watching the film

Table 2 Survey participant attitudes to the animated film

	%		
	Agree*	Disagree/neither†	
The film was easy to understand (n=237)	97.9	2.1	
The film contained useful information (n=238)	97.5	2.5	
The film was confusing (n=237)	4.6	95.4	
I trust that the film is credible (n=238)	93.7	6.3	
The film provided helpful explanations of ACEs (n=237)	94.1	5.9	
Watching the film made me feel upset or sad (n=239)	50.6	49.4	
Watching the film made me feel hopeful or encouraged (n=238)	66.4	33.6	
The film was difficult or distressing to watch (n=238)	15.1	84.9	
I gained something positive from watching the film (n=239)	81.2	18.8	
I am glad I watched the film (n=237)	94.9	5.1	
It is important that the issues in the film are talked about (n=237)	98.3	1.7	
I would like to know more about ACEs (n=222)	79.3	20.7	
It is important people understand ACEs (n=238)	98.3	1.7	
The film gave me a better understanding of the long-term effects of ACEs (n=238)	88.2	11.8	
I feel able to recognise what ACEs are (n=236)	93.2	6.8	
I feel better able to talk about ACEs (n=235)	82.6	17.4	
I would talk about ACEs if asked (n=237)	91.6	8.4	
ACEs can be prevented from happening (n=237)	81.0	19.0	
People with ACEs would benefit from watching this film (n=235)	84.3	15.7	
The film will benefit professionals who work with those affected by ACEs (n=235)	96.2	3.8	
I will discuss ACEs after seeing the film (n=234)	84.2	15.8	
The amount of information in the film was (n=232)	Too little	Just right	Too much
	8.2	89.7	2.2
The length of the film was (n=238)	Too short	Just right	Too long
	2.9	92.4	4.6

*Agree/strongly agree.

†Disagree/strongly disagree/neither.

ACE, adverse childhood experience.

made them feel hopeful or encouraged, nearly all participants reported that they felt that it was important that the issues in the film are talked about (98.3%; table 2).

Almost 8 in 10 (79.3%) survey participants reported that they agreed that they would like to know more about ACEs. The majority of participants reported that it is important that people understand ACEs (98.3%) and that the film gave them a better understanding of the long-term effects of ACEs (88.2%). ACE awareness following viewing was high, with 93.2% reporting that they agreed that they now felt able to recognise ACEs. Furthermore, high proportions agreed that they felt better able to talk about ACEs (82.6%) and that they would talk about ACEs if asked (91.6%), with 8 in 10 (81.0%) reporting that they felt ACEs could be prevented from happening and that people with ACEs would benefit from watching the film (84.3%). When limited to those who had reported exposure to one ACE or more (n=120), this increased to 88.9% reporting that they agreed that those with ACEs would benefit from watching the film. The majority (96.2%) reported that the film would benefit professionals who work with those affected by ACEs and over 8

in 10 (84.2%) reported that they would discuss ACEs after seeing the film.

There were no significant associations between attitudes to the film and participant age. Significantly more females reported that in their opinion the film was credible (95.6%; 87.0%, males; $p=0.049$). More participants in Wales reported that they disagreed, strongly disagreed or had no opinion (disagreed/neither) that the film was difficult or distressing to watch than in other locations (90.7%; England, 82.4%; other, 68.4%; $p=0.025$), while more participants in England reported that they agreed that the amount of information in the film was 'just right' (95.2%; Wales, 87.4%; other, 70.0%; $p<0.001$).

The prevalence of those agreeing that the film was difficult or distressing to watch increased with ACE count (11.4% of those with no ACEs compared with 47.4% of those with ≥ 4 ACEs; $p=0.001$). However, a similar pattern was found for those reporting that the film made them feel hopeful or encouraged (58.7% of those with no ACEs compared with 80.0% of those with ≥ 4 ACEs; $p=0.029$). No other demographic outcomes were associated with participant ACE count.

Table 3 Attitudes to the film by those who did and did not agree that the film made them feel upset or sad

		Watching the film made me feel upset or sad (%)			
		Disagree/neither	Agree	χ^2	P (Fisher's exact)
Watching the film made me feel hopeful or encouraged	Disagree/neither	45.8	21.7	15.480	<0.001
	Agree	54.2	78.3		
I am glad I watched the film	Disagree/neither	7.7	2.5	3.323	0.081
	Agree	92.3	97.5		
I gained something positive from watching the film	Disagree/neither	24.6	13.2	5.038	0.031
	Agree	75.4	86.8		
It is important that the issues in the film are talked about	Disagree/neither	2.6	0.8	1.069	0.366
	Agree	97.4	99.2		
I will discuss ACEs after seeing the film	Disagree/neither	22.1	9.9	6.540	0.012
	Agree	77.9	90.1		
The film gave me a better understanding of the long-term effects of ACEs	Disagree/neither	16.2	7.4	4.439	0.044
	Agree	83.8	92.6		
I feel better able to talk about ACEs	Disagree/neither	25.0	10.1	9.074	0.003
	Agree	75.0	89.9		

ACE, adverse childhood experience; agree, agree/strongly agree; disagree/neither, disagree/strongly disagree/neither.

A significantly higher proportion of those who agreed that the film made them feel upset or sad (compared with those who disagreed/neither) reported that they agreed that: the film gave them a better understanding of the long-term effects of ACEs; the film made them feel hopeful or encouraged; felt they had gained something positive from watching the film; felt better able to talk about ACEs and reported that they would discuss ACEs after seeing the film (table 3). However, there was no significant association between agreement that the film made them upset and sad and feeling glad to have watched the film or that it is important that the issues in the film are talked about.

Twitter Source

The 358 included tweets were generated from 313 unique user accounts (table 4). Most accounts (93.3%, n=292)

sent only one tweet, with mean tweets per account 1.14 (SD=0.73930). The number of followers for each account ranged from 13 to over 18000. Over 9 in 10 (95.0%, n=340) of the tweets could be assigned a geography from the user accounts. Of these, 84.4% of tweets were based in the UK (83.4% of user accounts), with 10.0% of tweets from North America (10.8% of user accounts). Of identifiable tweets from the UK's four nations, the majority were from users based in England (59.2%; 57.3% of users), with 17.1% in Wales (18.7% of users). Over two-thirds (67.4%) of user accounts were for individual users, with the remainder organisational accounts. Across all tweets, 65.4% had been 'liked' by other Twitter users. These tweets received a total of 1767 likes, range 1–232. Over half of all tweets (52.0%) regarding the film had been 'retweeted'—a process where users reshare the tweet with their followers. Tweets regarding the film had

Table 4 Twitter user demographics, sentiment and tweet interaction

			N	%
Users (n=313)	Mean number of tweets per user (range)		1.14 (1–9)	
	User geography	UK	246	83.4
		North America	32	10.8
		Other	17	5.8
		Unidentifiable	18	5.8
	User source	Individual	211	67.4
		Organisation	102	32.6
All tweets (n=358)	Tweet sentiment	Positive	140	39.1
		Neutral	213	59.5
		Negative	5	1.4
	Interaction with tweet	Liked	234	65.4
		Retweeted	186	52.0

been 'retweeted' a total of 1359 times, ranging from 1 to 229 times. Overall, 17% of tweets (n=61) had received a comment by another user, of which 60.7% of tweets received one comment, 24.6% received two comments and 14.7% received three or more comments (range 1–7).

Tweet sentiment

The majority of tweets (59.5%; [table 4](#)) were coded as expressing a neutral sentiment towards the film. These tweets predominately shared the animated film or stated that it had been published, without providing any indication of attitude towards it. Over a third (39.1%) had a positive sentiment, with only 1.4% (n=5) expressing negative sentiment. A comparison of sentiment versus user source (ie, individual or organisation) found no significant association (p=0.054). There was also no association between tweet sentiment and the interaction a tweet received (liked, p=0.774; 'retweeted', p=0.595 or commented on, p=0.226).

YouTube

As of 20 September 2019, the sum of the three language versions of the animated film published by Public Health Network Cymru had been viewed 156 068 times on the social media platform YouTube. Seven other organisations had published versions of the film, one used Dutch subtitles and all others were published in English. Across the versions uploaded by these publishers (excluding the original publisher), the film had been viewed an additional 15 744 times, resulting in a total online interaction on YouTube for the 13 versions of the animated film of 171 812 views. Interaction with the film was encouraging with 97.3% (n=889/914) of viewer ratings of the film being positive, that is, 'thumbs up'. For a detailed breakdown of the interaction for each video found see online supplemental table 1. Only two videos had received comments by YouTube viewers (one video had comments disabled by the publisher and one had only received marketing comments left by the publisher thus were excluded from analysis). Across the published videos, 14 comments had been left by 13 unique users, of which 28.6% (n=4) were in turn rated by other users with a positive sentiment, 28.6% (n=4) neutral and 42.8% (n=6) negative. None of the comments received a 'thumbs down', but the comments which were graded as positive in sentiment received a total of 31 'thumbs up', with neutral and negatively rated comments receiving 8 and 26 total 'thumbs up', respectively. No data on YouTube users are available to allow an understanding of the demographics of viewer or those who rated or commented on the films.

Other dissemination/use of the film

Information provided by the developers of the film (n=2) indicated that a wide range of requests had been made for permission to show the film. Reported examples of its use are shown in online supplemental table 2. The film had been shown to a variety of audiences including

police, health professionals and local authority employees predominantly within employee training. Use of the film was primarily in England and Wales, but international requests had been received.

DISCUSSION

This research has provided an insight into professional and public opinion on the use of a short animated film to convey public health messaging on ACEs. The triangulation of findings across 239 survey participants, 358 Twitter interactions and 171 812 YouTube views indicate a perceived acceptability of, and positive reaction to the film. Positive attitudes to the film were indicated among professionals, with the film perceived to be easy to understand, useful and its length and amount of information contained 'just right'. Furthermore, over 9 in 10 respondents reported that they felt the film was credible. Despite half of the survey sample reporting the experience of negative emotions (ie, feeling sad or upset) from viewing the film, few reported that they found the film difficult or distressing to watch. Furthermore, analysis showed that a high proportion of those who reported feeling sad or upset, positively reflected that the film had left them feeling hopeful or encouraged, they had gained something positive from watching the film, had a better understanding of ACEs, felt more able to talk about them and would discuss them after viewing the film. Evoking sadness may, however, have improved the communication of the film's message. Public health messages which evoke high levels of emotion, or strong negative emotions (eg, sadness), have been shown to be subject to better recall.^{32 33} The emotional tone of messaging has been found to be an important factor in an audience's perception of effectiveness and employing emotion including sadness in films is commonly used by advertising for charitable organisations.³⁴ Despite some participants indicating negative emotions, the film highlights an important subject matter and conveys it in a powerful way to positively impact professionals' understanding of ACEs, including how they can work with and support people affected by childhood adversity. Public viewer sentiment was also affirmative across both Twitter and YouTube interactions, with few tweets or YouTube comments being rated as having a negative sentiment and only 25 'Thumbs down' (less than 3% of all reactions recorded) received across the 13 published videos on YouTube.

To our knowledge, this is the first study to explore professional and public attitudes towards public health messaging on ACEs. To ensure sensitivity of the film to individuals who had experienced ACEs, we explored associations between professional perceptions of the film and self-reported ACE exposure. The majority of outcomes had no association with participant ACE count. A higher proportion of those reporting exposure to multiple ACEs in their childhood (ie, ≥4 ACEs) reported that they agreed that the film was difficult or distressing to watch, compared with those with no ACEs. However, a similar

trend was also identified with ACE exposure for agreeing that ‘watching the film made me feel hopeful or encouraged’. Furthermore, when limited to those reporting personal ACE exposure, almost 9 in 10 survey participants agreed that people with ACEs would benefit from watching this film. This finding is important as it confirms the sensitivity of the film to those who have experienced childhood trauma, highlighting that for the majority, this method of communication was deemed acceptable. Other research has also identified that the experience of adversity can lead to increased empathy and compassion for others.³⁵

A positive attitude among professionals was also identified towards their future communication on ACEs. Over 9 in 10 respondents reported that they felt it was important that the issues in the film are talked about. The majority (96.2%) agreed that the film would benefit professionals who work with those affected by ACEs and over 8 in 10 (84.2%) reported that they would discuss ACEs after seeing the film. Research internationally into routinely enquiring about ACEs (predominantly termed screening in studies from the USA) within a range of health and other professional services is expanding. Evidence for such enquiry is currently limited and show mixed findings.³⁶ Studies in the UK within general practice and health visitor services have identified that routine ACE enquiry is acceptable to patients and professionals.^{37 38} However, understanding of how enquiry can impact an individual’s short-term and long-term health and well-being, parenting outcomes or how best to respond to individuals who disclose ACE exposure is not understood.³⁶ Improving knowledge and understanding of ACEs is increasingly being embedded within local and national policy.^{8 9} In California, USA, the ACEs Aware Initiative set up by the California Surgeon General and the state Department of Health Care Services is partnering with organisations to ensure providers have the resources and training required to incorporate ACE awareness and ACE screening into child and adult patient healthcare (see <https://www.acesaware.org/about-aces-aware/aces-aware/>). ACE-Aware Scotland aims to help all Scottish citizens better understand the impact of ACEs, with the objective to become the first ACE aware nation (<https://aceawarescotland.com/>). The majority of participants in the survey sample here had viewed the film within continuing professional development. In Wales, the Welsh ACE Hub has delivered training on ACEs to police, youth justice and primary and secondary schools in order to bring about transformation change (see <https://www.aceawarewales.com/about>).¹⁰ Research measuring the Welsh public service workforce knowledge and awareness of ACEs (2253 respondents) identified a range of mediums as sources of ACE information—including videos (54%) and social media (31%).¹⁰ Although data are not available on which video and social media individuals were referring to, with limited resource availability these wider health workforce figures may predominantly relate to the ACE film examined here. Such findings also

highlight the growing trend for social media and online content as a source of public health knowledge and knowledge dissemination.^{16 21}

Social media is increasingly being used to explore attitudes towards public health messaging or interventions. Examples of the use of Twitter data in public health research include: understanding dental pain,³⁹ sentiment of posts on diabetes⁴⁰ and public attitudes towards: vaccination,^{41 42} the introduction of minimum alcohol pricing,³⁰ alcohol guidelines,²⁷ mammography screening,²⁴ waterpipe smoking⁴³ as well as users’ experience of loneliness,⁴⁴ mental health and suicidality.⁴⁵ Although the film evaluated here was not developed for health promotion like many of these examples, an understanding of interaction with it on social media presents an indication of wider reaction to the film. Findings from social media here, indicate notably little negative sentiment (1.4% of tweets captured) and no association between tweet interaction (ie, likes, comments and retweets) and sentiment. However, it should be noted for the interpretation of findings that Twitter offers users a ‘like’ function, but no direct function is available to enable a user to show that they do not like the content of a tweet. The findings of this study add to the evidence base for films to support public health messaging and the use of Twitter data to explore user interaction and sentiment. However, further research could explore attitudes towards the animated film with the wider public. Although only 0.6% of all 171812 views of the film on YouTube provided a viewer reaction, where left, they were overwhelmingly positive (97.3%, ‘thumbs up’). Further research with the public could explore these patterns in more detail given the ways in which the use of the film has organically grown since its launch to include use in training by other organisations and the subsequent publication of the film in other languages.

This study has a number of limitations that should be recognised. The survey sample was small, with males and youth under-represented and it is not possible to identify any selective bias created by non-participation. Survey participants were professionals, predominantly working in health, social service or other public sectors and approximately 6 in 10 had viewed the film as part of continuing professional development (ie, training or conference attendance). The survey did not include any direct measure of participants’ knowledge of ACEs prior to or after viewing the film, nor if they thought their practice would change as a result of viewing the film. As the survey was anonymous we were also unable to follow participants up to explore such changes. However, a high proportion of respondents reported feeling better able to talk about ACEs after viewing the film and that they would talk about ACEs if asked. We were also unable to explore if the film’s evocation of sadness led to increased long-term memorability and recall, nor participants’ views on the focus of film content. Future research should consider exploring the longer-term impacts of viewing ACE communication materials on recall and change in

practice, along with perceptions on the focus of such ACE communication. Here, we focused on perceptions towards the film, including examining perceptions by participant ACE count. ACEs were retrospectively self-reported and therefore, like other studies using an ACE methodology, our study may be affected by willingness to report and accurate recall. However, to minimise this, participants were asked to report their ACE count rather than their exposure to individual ACEs. Further, ACE prevalence identified in the sample was similar to that seen in UK population studies (here, 46.7% no ACEs, 8.9% ≥ 4 ACEs; England and Wales, 46.2% no ACEs, 10.3% ≥ 4 ACEs),⁴⁶ and findings indicate few associations between reported attitudes towards the film and ACE exposure.

A strength of this research is the use of mixed methods with varied samples to explore attitudes towards the film. A moderate reach of the film with the public was identified on Twitter—with over 350 interactions—but the majority of the user profiles were UK based. Additional geographical spread in film use was identified through YouTube publication of additional film versions and in the examples of film use shared by the publisher. The standard Twitter search interface does not include all tweets, as the facility is only able to retrieve tweets from publicly available accounts. We included a large range of keywords incorporating acronyms (eg, ‘ACEs’) in structured searches to ensure the collection of all relevant tweets. Captured tweets related to a relatively small number of users, who are unlikely to be representative of professionals or the general population. Previous research has identified that Twitter users can appear in ‘echo-chambers’—thus are surrounded and followed by accounts with similar views.³⁰ However, data from social media allow the examination of dynamic responses towards the film and also demonstrates its wider reach. Many Twitter accounts provided limited biographical information, thus limiting any further exploration of user profile and online film dissemination. We were also unable to verify if users whose tweets were captured here were expressing their own opinions and if the users who reacted to these tweets (ie, liked, retweeted or commented on them) had themselves viewed the animated film. Furthermore, analysis of online content can be difficult to interpret, for example sarcasm.^{40–42} However, two reviewers assessed all online content for sentiment analysis and levels of agreement between reviewers were consistently high (see Methods).

Despite the study limitations, findings across the mixed methods show positive attitudes to the film and the online survey found that attitudes were largely consistent irrespective of exposure to ACEs. Monitoring online responses to public health messaging can provide valuable feedback.²⁷ The findings identified here are of use to the development of policy and practice on ACEs in the UK and globally. The results indicate that the use of a short animated film to educate and communicate key messages on ACEs to professionals and the public may be acceptable and appropriate. Future research would provide valuable feedback to further explore the trends

identified. Research should explore with larger and more generalisable samples of the public, attitudes towards and use of this film to convey education to a broad audience on ACEs. Future research could also include feedback from participants on alternative methods for communicating public health messages on ACEs, which unfortunately was not able to be addressed within this study. This would add to the growing evidence base on understanding of ACEs, their communication, enquiry and how those who have experienced or are experiencing ACEs can be provided with appropriate support.

An increasing ACE awareness offers the potential to services to be configured around the needs of the population. Evidence suggests some providers are unaware of ACEs and lack training on how to support and work with those exposed to them.³⁶ Increasing ACE awareness can further enable services to operate in an ACE-informed way—one which is compassionate to users and ensures staff have the confidence, skills and knowledge to identify ACEs and signpost those who are or have experienced them to appropriate support. Internationally, major movements now exist to increase ACE awareness and embed such change in policy. Materials which are developed for the purpose of increasing ACE awareness, even if specifically designed for professional training, are likely to become accessible within the public domain. As such, it is therefore important to understand attitudes towards these materials across a range of individuals including the general public. The public and professional response, as identified here, offers a starting point for the future development of the literature to inform both professional and individual understanding. International examples of the films use were found, with requests for translation into Lithuanian and Dutch and a New Zealand accent, with its use across a variety of audiences. These examples demonstrate how material developed for one setting can be adapted for use more broadly. Continuing to explore attitudes towards such resources is essential as more areas seek to drive local, regional and national change towards the prevention of ACEs and mitigation of their associated negative life outcomes.

Twitter Mark A Bellis @markabellis, Kate R Isherwood @Isherwood_Kate and Karen E Hughes @keh444

Acknowledgements The authors would like to thank all the participants who gave their time to complete the survey. The authors would also like to thank Helen Lowey and Hannah Grey for survey development and data collection; David Jones, Afonso Palma and Catherine Sharp for assistance with data extraction and Tracy Black and Andrew Bennett for assistance in compiling examples of the films’ use.

Contributors The study was designed by MAB, KEH and KF. Authors KF and KRI undertook data extraction and analysis.

Funding The survey included in this study was undertaken as part of a PhD study that was supported and funded by Public Health Wales and Blackburn with Darwen Borough Council (award/grant number N/A).

Competing interests MAB was part of a team of people who helped develop the animation concept and content but receives no funding from its use or distribution.

Patient consent for publication Not required.

Ethics approval Ethical approval for the study was obtained from Bangor University's Healthcare and Medical Sciences Ethics Committee (2017-15984, 2018-16327).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Kat Ford <http://orcid.org/0000-0002-2984-5838>

Mark A Bellis <http://orcid.org/0000-0001-6980-1963>

Kate R Isherwood <http://orcid.org/0000-0002-6857-4268>

Karen E Hughes <http://orcid.org/0000-0001-8097-3395>

REFERENCES

- Felitti VJ, Anda RF, Nordenberg D, *et al.* Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the adverse childhood experiences (ACE) study. *Am J Prev Med* 1998;14:245–58.
- Hughes K, Bellis MA, Hardcastle KA, *et al.* The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *Lancet Public Health* 2017;2:e356–66.
- Hardcastle K, Bellis MA, Ford K, *et al.* Measuring the relationships between adverse childhood experiences and educational and employment success in England and Wales: findings from a retrospective study. *Public Health* 2018;165:106–16.
- Ford K, Barton E, Newbury A. Understanding the prevalence of adverse childhood experiences (ACEs) in a male offender population in Wales: the prisoner ACE survey. *Wrexham* 2019.
- Anda RF, Felitti VJ, Bremner JD, *et al.* The enduring effects of abuse and related adverse experiences in childhood. *Eur Arch Psychiatry Clin Neurosci* 2006;256:174–86.
- Bellis MA, Hughes K, Ford K, *et al.* Life course health consequences and associated annual costs of adverse childhood experiences across Europe and North America: a systematic review and meta-analysis. *Lancet Public Health* 2019;4:e517–28.
- Hughes K, Ford K, Kadel R, *et al.* Health and financial burden of adverse childhood experiences in England and Wales: a combined primary data study of five surveys. *BMJ Open* 2020;10:e036374.
- Garner AS, Shonkoff JP, *et al.* Committee on Psychosocial Aspects of Child and Family Health. Early childhood adversity, toxic stress, and the role of the pediatrician: translating developmental science into lifelong health. *Pediatrics* 2012;129:e224 LP–31.
- Welsh Government. Prosperity for all: the national strategy, 2017. Available: <http://gov.wales/about/programme-for-government/?lang=en>
- Riley G, Bailey J, Bright D. *Knowledge and awareness of adverse childhood experiences (ACEs) in the public service workforce in Wales: a national survey*. Cardiff, 2019. <https://phw.nhs.wales/news/new-survey-shows-both-good-welsh-public-sector-awareness-of-adverse-childhood-experiences-aces-and-opportunities-for-improvement/knowledge-and-awareness-of-adverse-childhood-experiences-in-the-public-service-workforce-in-wales/>
- Bellis MA, Ashton K, Hughes K. *Adverse childhood experiences and their impact on health-harming behaviours in the Welsh population*. Cardiff, 2015. [https://www2.nphs.wales.nhs.uk/PRIDDocs.nsf/7c21215d6d0c613e80256f490030c05a/d488a3852491bc1d80257f370038919e/\\$FILE/ACE%20Report%20FINAL%20\(E\).pdf](https://www2.nphs.wales.nhs.uk/PRIDDocs.nsf/7c21215d6d0c613e80256f490030c05a/d488a3852491bc1d80257f370038919e/$FILE/ACE%20Report%20FINAL%20(E).pdf)
- Bellis MA, Lowey H, Leckenby N, *et al.* Adverse childhood experiences: retrospective study to determine their impact on adult health behaviours and health outcomes in a UK population. *J Public Health* 2014;36:81–91.
- Bellis MA, Hughes K, Leckenby N, *et al.* National household survey of adverse childhood experiences and their relationship with resilience to health-harming behaviors in England. *BMC Med* 2014;12:72.
- Sinor MZ. Comparison between conventional health promotion and use of Cartoon animation in delivering oral health education. *Int J Humanit Soc Sci* 2011;1:169–74 https://www.researchgate.net/publication/236263384_Comparison_between_Conventional_Health_Promotion_and_Use_of_Cartoon_Animation_in_Delivering_Oral_Health_Education
- Leiner M, Handal G, Williams D. Patient communication: a multidisciplinary approach using animated cartoons. *Health Educ Res* 2004;19:591–5.
- Kapp JM, Hensel B, Schnoring KT. Is Twitter a forum for disseminating research to health policy makers? *Ann Epidemiol* 2015;25:883–7.
- Neiger BL, Thackeray R, Burton SH, *et al.* Evaluating social media's capacity to develop engaged audiences in health promotion settings: use of Twitter metrics as a case study. *Health Promot Pract* 2013;14:157–62.
- Allem J-P, Escobedo P, Chu K-H, *et al.* Campaigns and counter campaigns: reactions on Twitter to e-cigarette education. *Tob Control* 2017;26:226–9.
- Kemp S. The global state of digital in 2019, 2019. Available: <https://hootsuite.com/resources/digital-in-2019> [Accessed 05 Nov 2019].
- Twitter. 2020. Q3 2020 Investor factsheet.
- Sinnenberg L, Buttenheim AM, Padrez K, *et al.* Twitter as a tool for health research: a systematic review. *Am J Public Health* 2017;107:e1–8.
- Li HO-Y, Bailey A, Huynh D, *et al.* Youtube as a source of information on COVID-19: a pandemic of misinformation? *BMJ Glob Health* 2020;5:e002604.
- Edo-Osagie O, De La Iglesia B, Lake I, *et al.* A scoping review of the use of twitter for public health research. *Comput Biol Med* 2020;122:103770.
- Nastasi A, Bryant T, Canner JK, *et al.* Breast cancer screening and social media: a content analysis of evidence use and guideline opinions on Twitter. *J Cancer Educ* 2018;33:695–702.
- Lynch BA, Agunwamba A, Wilson PM, *et al.* Adverse family experiences and obesity in children and adolescents in the United States. *Prev Med* 2016;90:148–54.
- Jacobson J, Mascaró C. Movement: twitter conversations of a hairy social movement. *Social Media + Society* 2016;2:205630511663710.
- Stautz K, Bignardi G, Hollands GJ, *et al.* Reactions on twitter to updated alcohol guidelines in the UK: a content analysis. *BMJ Open* 2017;7:e015493.
- Bravo CA, Hoffman-Goetz L, Prostate TA. Tweeting about prostate and testicular cancers: do twitter conversations and the 2013 november Canada campaign objectives align? *J Cancer Educ* 2016;31:236–43.
- Rivers CM, Lewis BL. Ethical research standards in a world of big data [version 2; peer review: 3 approved with reservations]. *F1000Res* 2014;3.
- Astill Wright L, Golder S, Balkham A, *et al.* Understanding public opinion to the introduction of minimum unit pricing in Scotland: a qualitative study using twitter. *BMJ Open* 2019;9:e029690.
- Taylor J, Pagliari C. Comprehensive scoping review of health research using social media data. *BMJ Open* 2018;8:e022931.
- Biener L, Ji M, Gilpin EA, *et al.* The impact of emotional tone, message, and broadcast parameters in youth anti-smoking advertisements. *J Health Commun* 2004;9:259–74.
- Dunlop S, Wakefield M, Kashima Y. Can you feel it? negative emotion, risk, and narrative in health communication. *Media Psychol* 2008;11:52–75.
- Bagozzi RP, Moore DJ. Public service advertisements: emotions and empathy guide prosocial behavior. *J Mark* 1994;58:56–70.
- Lim D, DeSteno D. Suffering and compassion: the links among adverse life experiences, empathy, compassion, and prosocial behavior. *Emotion* 2016;16:175–82.
- Ford K, Hughes K, Hardcastle K, *et al.* The evidence base for routine enquiry into adverse childhood experiences: a scoping review. *Child Abuse Negl* 2019;91:131–46.
- Hardcastle K, Bellis M. Routine enquiry for history of adverse childhood experiences (ACEs) in the adult patient population in a general practice setting: a pathfinder study Wrexham Public Health Wales NHS Trust; 2018. https://www.researchgate.net/publication/327418846_Routine_enquiry_for_history_of_adverse_childhood_experiences_ACEs_in_the_adult_patient_population_in_a_general_practice_setting_A_pathfinder_study

- 38 Hardcastle K, Bellis MA. Asking about adverse childhood experiences (ACEs) in health visiting: findings from a pilot study Public Heal Wales; 2019. https://www.researchgate.net/publication/332222562_Asking_about_adverse_childhood_experiences_ACEs_in_General_Practice_Evaluation_findings_from_a_pilot_study_in_Anglesey_North_Wales
- 39 Heavilin N, Gerbert B, Page JE, *et al.* Public health surveillance of dental pain via twitter. *J Dent Res* 2011;90:1047–51.
- 40 Gabarron E, Dorronzoro E, Rivera-Romero O, *et al.* Diabetes on twitter: a sentiment analysis. *J Diabetes Sci Technol* 2019;13:439–44.
- 41 Keim-Malpass J, Mitchell EM, Sun E, *et al.* Using twitter to understand public perceptions regarding the #HPV vaccine: opportunities for public health nurses to engage in social marketing. *Public Health Nurs* 2017;34:316–23.
- 42 Tavoschi L, Quattrone F, D'Andrea E, *et al.* Twitter as a sentinel tool to monitor public opinion on vaccination: an opinion mining analysis from September 2016 to August 2017 in Italy. *Hum Vaccin Immunother* 2020;16:1062–9.
- 43 Grant A, O'Mahoney H. Portrayal of waterpipe (shisha, hookah, nargile) smoking on twitter: a qualitative exploration. *Public Health* 2016;140:128–35.
- 44 Guntuku SC, Schneider R, Pelullo A, *et al.* Studying expressions of loneliness in individuals using twitter: an observational study. *BMJ Open* 2019;9:e030355.
- 45 O'Dea B, Wan S, Batterham PJ, *et al.* Detecting suicidality on twitter. *Internet Interv* 2015;2:183–8.
- 46 Bellis M, Hughes K, Hardcastle K, *et al.* The impact of adverse childhood experiences on health service use across the life course using a retrospective cohort study. *J Health Serv Res Policy* 2017;22:168–77.